1] The neural network of Fig.1. has an input data Pattern (x_1, x_2) and produces a binary threshold signal s. It is required to behave as a two-class data classifier through implementation of a logic AND function.

a) Find appropriate values for the weights w_{13}, w_{23}, and w_{03}.

b) Determine the equation of the separation line.

c) How will the network classify the input data patterns (0,1), (1,0), and (1,1)?

d) How will the network classify the input data patterns (0.5, 0.5), (0.5, 1.5), and (0, -0.5)?

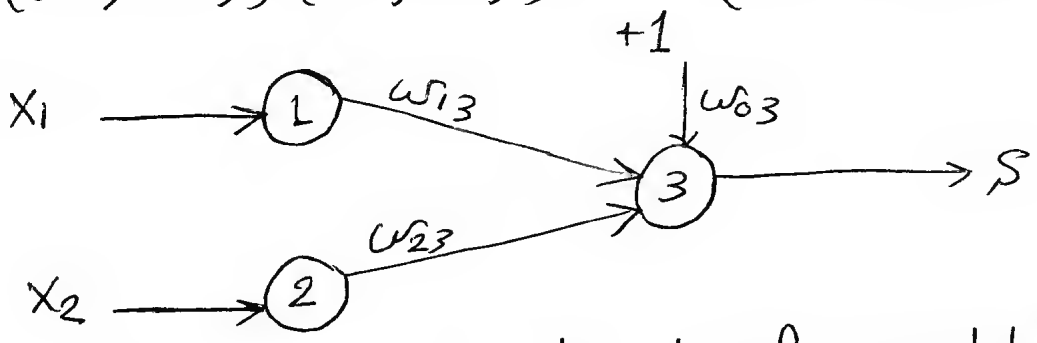

Fig.1 : Neural network for Problem.1.

2] Repeat problem.1 when the network implements a logic OR function.

3] Repeat problem.1 when the network implements a logic NAND function. Compare the solution with that of problem.1.

4] Repeat problem-1 when the network implements a logic NOR function. Compare the solution with that of problem.2.

5] Repeat problem.1 when the network implements a logic function $x_1'x_2$.

6] Repeat problem.1 when the network implements a logic function $x_1 x_2'$.

7] Repeat problem-1 when the network implements a logic function $x_1 + x_2'$. Compare the solution with that of problem.5.

8] Repeat problem.1. when the network implements a logic function $x_1' + x_2$. Compare the solution with that of problem.6.

9] Consider the neural network of Fig.1, with an input data pattern (x_1, x_2) and a binary threshold signal S. This network is required to behave as a two-class data classifier with a separation line, in the $x_1 - x_2$ plane, of the form

$$0.5x_1 - x_2 + 1 = 0$$

The point (0,0) lies in the region specified by a signal $S = 1$.

a) Find appropriate values for the weights w_{13}, w_{23}, and w_{03}

b) How will the network classify the input data Patterns (1,1), (−1,1), and (1,2)?

10] Repeat problem.9 when the Point (0,0) lies in the region specified by a signal S=0.

11] Consider the neural network of Fig.1, with an input data Pattern (x_1, x_2) and a bipolar threshold signal S. This network is required to behave as a two-class data classifier, with the separation line shown in Fig.2. The numerical value of the bias weight w_{03} should not exceed unity. How will the input data patterns (0.2, 0.3), (1.4, 2.7), and (−1.1, 0.85) be classified?

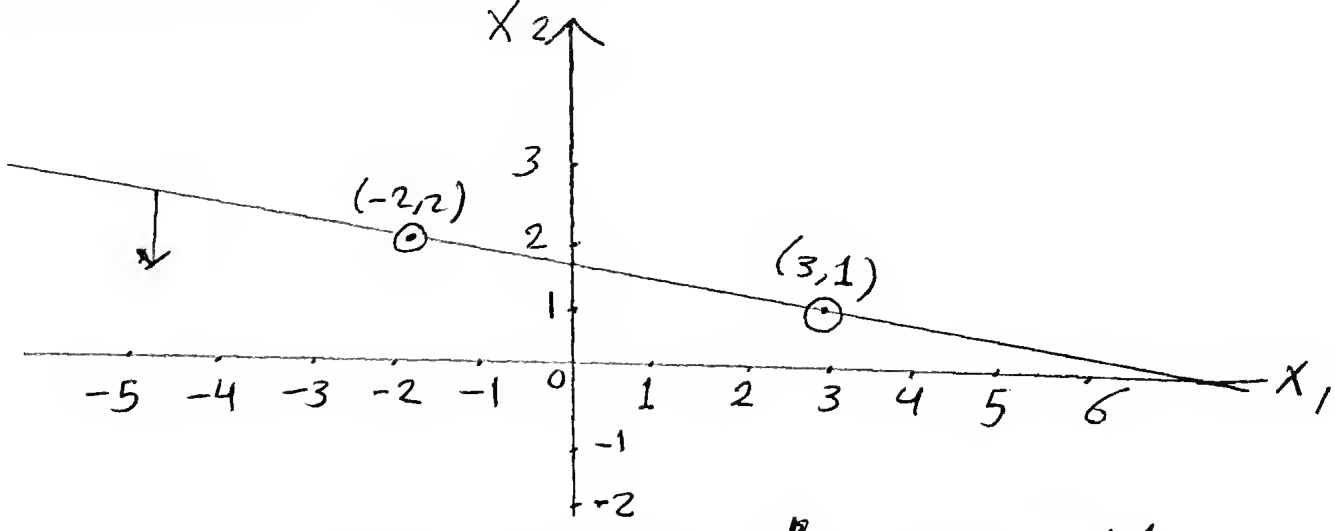

Fig.2 : Separation line for problem-11

12] Repeat problem-11 when the orientation of the separation line is reversed.

13] The neural network of Fig.3 has an input data Pattern (x_1, x_2). All 5 neurons of the hidden and output layers produce binary threshold signals. The weight values are :

$w_{13} = -1$, $w_{23} = 1$, $w_{03} = -0.5$

$w_{14} = 1$, $w_{14} = -1$, $w_{04} = -0.5$

$w_{35} = 1$, $w_{45} = 1$, $w_{05} = -0.5$.

a) Show that the network can behave as a two-class data classifier through implementation of a logic XOR function.

b) determine the equation of the separation lines.

c) How will the network classify the input data Patterns (0, 0), (0, 1), and (1, 1)?

d) How will the network classify the input data Patterns (1, -1), (-1, 1) and (0.5, 0.7)?

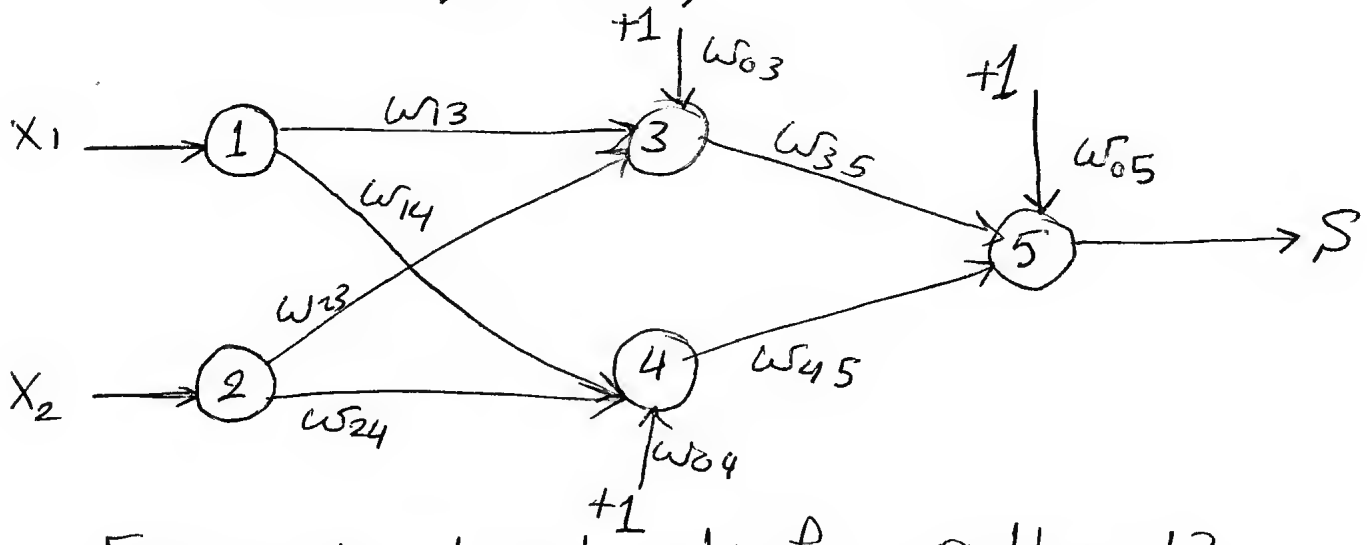

Fig.3 : Neural network for problem 13.

14] Repeat problem 13 when the weight values are:

$w_{13} = -0.5$, $w_{23} = 0.8$, $w_{03} = -0.4$

$w_{14} = 0.4$, $w_{24} = -0.2$, $w_{04} = -0.3$

$w_{35} = 1$, $w_{45} = 1$, $w_{05} = -0.5$

15 In problem. 14, determine the point of intersection of the separation lines. Also show how the input Pattern (2,2) is classified.

16 Consider the neural network of Fig. 3. All neurons of the hidden and output layers produce binary threshold signals. The weight values are:

$w_{13} = 1$, $w_{23} = 1$, $w_{03} = -1.5$

$w_{14} = -1$, $w_{24} = -1$, $w_{04} = 0.5$

$w_{35} = 1$, $w_{45} = 1$, $w_{05} = -0.5$

a) Show that the network can behave as a two-class data classifier through implementation of a logic XNOR function.

b) Determine the equations of the separation lines.

c) How will the network classify the input data Patterns (0,0), (0,1) and (1,1)?

d) How will the network classify the input data Patterns (1,-1), (-1,1), and (0.5,0.7)?

17] Repeat problem. 16 when the weight values are:

$w_{13} = -0.25$, $w_{23} = -1$, $w_{03} = 0.2$

$w_{14} = 1.5$, $w_{24} = 1$, $w_{04} = -1.8$

$w_{35} = 0.9$; $w_{45} = 0.8$, $w_{05} = -0.6$

18] In problem 17, determine the point of intersection of the separation lines. Also show how the input patterns $(2, -0.8)$, $(0.8, 0)$ and $(0, 1.8)$ are classified.